IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	:	
DOWNS et al.	:	MERCURY CONTROL IN
Parent Filed: MARCH 31, 1999	:	A WET SCRUBBER
Parent Serial No.: 09/282,817	:	USING HYDROGEN
Parent Art Unit: 1754	:	SULFIDE
Parent Examiner: VANOY	:	(Case 6013 D; Parent Case 6013)

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

In advance of the first Office Action on the merits in the above-identified divisional application, please amend the present application as follows:

IN THE TITLE

Please replace the title of the application on page 1 (and stated above) with the following title:

- -METHOD FOR CONTROL OF MERCURY- -

IN THE SPECIFICATION

Prior to the first paragraph of page 1 of the application, please insert the following paragraph:

> This is a divisional application of U.S. Serial No.09/282,817, now U.S. Patent No. xxxx.

Please replace the paragraph beginning on page 6, line 9, with the following:

> As illustrated in Fig. 1, and proceeding in the direction of flue gas flow generated during the combustion process, the boiler installation 10 includes a furnace 12 having a gas outlet 14 which conveys flue gases, generally designated 16, to an air heater 18 used to preheat incoming air 20 for combustion. Pulverizers 22 grind a fossil fuel 24 (e.g., coal) to a desired fineness and the pulverized coal 24 is conveyed via burners 25 into the furnace 12 where it is burned to release heat used to generate steam for use by a steam turbine-electric generator (not shown). Flue gas 16 produced by the combustion process are

conveyed through the gas outlet 14 to the air heater 18 and thence to various types of downstream flue gas cleanup equipment. The flue gas cleanup equipment may comprise a fabric filter or, as shown, an electrostatic precipitator (ESP) 26 which removes particulates from the flue gas 16. A flue 28 downstream of the ESP 26 conveys the flue gas 16 to a wet scrubber absorber module 30 which is used to remove sulfur dioxide and other contaminants from the flue gas 16. H_2S generation system 50 is optimally provided along flue 28. Generation system 50 permits the injection of H_2S into flue gas 16 via injection apparatus 76. Both generation system 50 and injection apparatus 76 are described in greater detail *infra*. Flue gas 16 exiting from the wet scrubber absorber module or, simply, the wet scrubber 30, is conveyed to a stack 32 and exhausted to atmosphere. Forced draft fans 34 and induced draft fans 36 are used to propel the air 20, fuel 24, and flue gases 16 through the installation 10. For further details of various aspects of such installations 10, the reader is referred to STEAM its generation and use, 40th Ed., Stultz and Kitto, Eds., Copyright © 1992 The Babcock & Wilcox Company, particularly to Chapter 35 - Sulfur Dioxide Control, the text of which is hereby incorporated by reference as though fully set forth herein. While the aforementioned STEAM reference contains a description of one form of wet scrubber 30 produced by The Babcock & Wilcox Company (B&W) and to which the present invention is applicable, the present invention is not limited to such B&W wet scrubber designs. Persons skilled in the art will appreciate that the principles of the present invention apply equally well to other types of wet scrubber designs, available from other manufacturers.

Please replace the paragraph beginning on page 7, line 10, with the following:

Referring now to Fig. 2 in particular, there is shown an embodiment of a system for accomplishing the method of injecting small amounts of H_2S into flue gas for mercury removal according to the present invention. ESP 26, wet scrubber slurry 38, recirculation pumps 40, absorber spray headers 44 and wet scrubber outlet 46 are provided in a similar fashion as described *supra*. An H_2S generation system, generally referred to as 50, is provided and includes a well-stirred tank containing a liquid section 54 comprising sodium and/or potassium sulfide and a gas section 52 where air and H_2S are mixed and the mixture 74 of air and H_2S is transferred to an injection apparatus 76, described *infra*. The H_2S vapor pressure in the tank 51 is controlled by pH. The pH in the tank 51 liquid solution 54 is controlled by the addition of a strong mineral acid 56, such as hydrochloric or sulfuric acid (HCl or H_2SO_4) from a tank or container 58, or by the addition of an alkali solution 57 such as sodium carbonate or sodium hydroxide (NaOH or Na_2CO_3) from a tank or container 85. The acid is added to lower the pH and increase the H_2S vapor pressure in tank 51. The alkali is added to raise the pH and lower the H_2S vapor pressure in tank 51. The H_2S produced is immediately transported to the injection system 76. This is an inherent safety feature since no gaseous H_2S is allowed to accumulate. Stirring or mixing means, advantageously comprising a motor 64 and driven stirring shaft with two paddles 66, keep the tank sections 52 and 54 well stirred. As a result, the constituents in the liquid

zone 54 are well mixed to yield the H_2S at the desired vapor pressure and the air 68 and generated H_2S are well mixed in the gas section 52. Pumping means 60 conveys the mineral acid 56 to the tank 51 via line 62; pumping means 61 conveys the alkali solution 57 to the tank 51 via line 63. Suitable control valves in lines 62 and 63 would be used as needed to control the flow of acid 56 and alkali 57.

Please replace the paragraph beginning on page 8, line 28, with the following:

As described earlier and as illustrated in Fig. 6, the present invention is also applicable to combustion systems employing dry scrubbers for flue gas desulfurization. Again, like reference numerals designate the same or functionally similar parts, including installation 10, forced draft fans 34 and induced draft fans 36. Flue gas 16 produced by the combustion process are conveyed through the gas outlet 14 to the air heater 18 and thence to various types of downstream flue gas cleanup equipment. A flue 28 conveys the flue gas 16 to a dry scrubber absorber module 150 which is used to remove sulfur dioxide and other contaminants from the flue gas 16. Flue gas 16 exiting from the dry scrubber 150 is conveyed to a fabric filter or, as shown, an electrostatic precipitator (ESP) 26 which removes particulates from the flue gas 16 and then the flue gas 16 is conveyed to a stack 32 and exhausted to atmosphere. Forced draft fans 34 and induced draft fans 36 are used to propel the air 20, fuel 24, and flue gases 16 through the installation 10 as before. Waste from ESP 26 and dry scrubber 150 are removed via waste disposal system 160, or other means well known to those skilled in the art.

Please replace the Abstract paragraph on page 15 with the following:

A method and apparatus for reducing mercury in industrial gases such as the flue gas produced by the combustion of fossil fuels such as coal adds hydrogen sulfide to the flue gas in or just before a scrubber of the industrial process which contains the wet scrubber. The method and apparatus of the present invention is applicable to installations employing either wet or dry scrubber flue gas desulfurization systems. The present invention uses kraft green liquor as a source for hydrogen sulfide and/or the injection of mineral acids into the green liquor to release vaporous hydrogen sulfide in order to form mercury sulfide solids.

IN THE CLAIMS

Please cancel claims 1-15 and 34-37.

REMARKS

Claims 16-32 have been canceled. Claims 1-15 and 33 remain in the case.

The Examiner will appreciate that the present application is a divisional application. In particular, the immediate and only parent of the present application upon which the present application relies for pendency and priority is recited in the caption above. A Notice of Allowability for the parent application was mailed on March 29, 2001. Notably, the allowed claims of the parent application were drawn to an apparatus for control of mercury and specifically included amended claims 16, 18-27, 29-32 and 34-37.

The preliminary amendments to the title and specification above are intended to address previous objections not related to the patentability of the claims that arose during the prosecution of the parent application. Also, applicants will further amend the first paragraph of the specification of the present application by replacing the "xxxx" with appropriate information once the patent number of the parent application is known.

Accordingly, applicants await a first Office Action on the merits.

CERTIFICATE OF MAILING BY EXPRESS MAIL

I hereby certify that this correspondence is being deposited with the United States Postal Service as "Express Mail" in an envelope addressed to: Assistant Commissioner for Patents, Box CPA, Washington, DC 20231 on June 26, 2001 **by "Post Office to Addressee" service which envelope bears the "Express Mail" label number:** EI 325771 374 US

Gayle Hamilton

Name of person mailing

Gayle L Hamilton 6/26/01

Signature **Date**

Respectfully submitted,

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MARKED UP VERSION TO SHOW CHANGES

IN THE TITLE

Please note that the title of the application has been changed in its entirety.

IN THE SPECIFICAITON

A paragraph has been added prior to the first paragraph of the application.

The paragraph beginning on page 6, line 9, had been amended as follows (note that the book title "STEAM" was previously underlined in the original text, and it has not been changed):

> As illustrated in Fig. 1, and proceeding in the direction of flue gas flow generated during the combustion process, the boiler installation 10 includes a furnace 12 having a gas outlet 14 which conveys flue gases, generally designated 16, to an air heater 18 used to preheat incoming air 20 for combustion. Pulverizers 22 grind a fossil fuel 24 (e.g., coal) to a desired fineness and the pulverized coal 24 is conveyed via burners 25 into the furnace 12 where it is burned to release heat used to generate steam for use by a steam turbine-electric generator (not shown). Flue gas 16 produced by the combustion process are conveyed through the gas outlet 14 to the air heater 18 and thence to various types of downstream flue gas cleanup equipment. The flue gas cleanup equipment may comprise a fabric filter or, as shown, an electrostatic precipitator (ESP) 26 which removes particulates from the flue gas 16. A flue 28 downstream of the ESP 26 conveys the flue gas 16 to a wet scrubber absorber module 30 which is used to remove sulfur dioxide and other contaminants from the flue gas 16. H_2S generation system 50 is optimally provided along flue 28. Generation system 50 permits the injection of H_2S into flue gas 16 via injection apparatus 76. Both generation system 50 and injection apparatus 76 are described in greater detail *infra.* Flue gas 16 exiting from the wet scrubber absorber module or, simply, the wet scrubber 30, is conveyed to a stack 32 and exhausted to atmosphere. Forced draft fans 34 and induced draft fans 36 are used to propel the air 20, fuel 24, and flue gases 16 through the installation 10. For further details of various aspects of such installations 10, the reader is referred to STEAM its generation and use, 40th Ed., Stultz and Kitto, Eds., Copyright © 1992 The Babcock & Wilcox Company, particularly to Chapter 35 - Sulfur Dioxide Control, the text of which is hereby incorporated by reference as though fully set forth herein. While the aforementioned STEAM reference contains a description of one form of wet scrubber 30 produced by The Babcock & Wilcox Company (B&W) and to which the present invention is applicable, the present invention is not limited to such B&W wet scrubber designs. Persons skilled in the art will appreciate that the principles of the present invention apply equally well to other types of wet scrubber designs, available from other manufacturers.

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scrubber 150 are removed via waste disposal system 160, or other means well known to those skilled in the art.

The Abstract paragraph on page 15 has been amended as follows:

A method and apparatus for reducing mercury in industrial gases such as the flue gas produced by the combustion of fossil fuels such as coal adds hydrogen sulfide to the flue gas in or just before a scrubber of the industrial process which contains the wet scrubber. The method and apparatus of the present invention is applicable to installations employing either wet or dry scrubber flue gas desulfurization systems. The present invention uses kraft green liquor as a source for hydrogen sulfide and/or the injection of mineral acids into the green liquor to release vaporous hydrogen sulfide in order to form mercury sulfide solids.